C O R E
Metadata, cit
Provided by DigitalCommons@CalPoly

OPTIMAL PALM OIL PROCESSING PLANT SIZE IN SOUTH SUMATERA

Presented to the

Faculty of the Agribusiness Department

California Polytechnic State University

In Partial Fulfillment

of the Requirement for the Degree

Bachelor of Science

by

Shelly Vidliana Gozali

Fall 2010

APPROVAL PAGE

TITLE: Optimal Palm Oil Processing Plant Size in South Sumatera

AUTHOR: Shelly Vidliana Gozali

DATE SUBMITTED: 6 December 2010

Xiaowei Cai
Senior Project Advisor

Signature

ABSTRACT

This study was conducted to determine if the palm oil processing plant with a capacity of thirty tons per hour is the optimal size for the Sutopo Lestari Jaya Company. This report represents two important techniques when performing the analysis. A net present value has been calculated in determining the feasibility of the palm oil processing plant in the next ten years after it is built. A break-even analysis has been performed to determine the number of unit produced to cover the fixed cost after the processing plant operates.

It is concluded that the processing plant with a capacity of thirty tons per hour currently is the optimal size for the Sutopo Lestari Jaya Company. This conclusion is based on the investment analyses that provide a net present value of $82,687,352 in ten years period and break-even point at 1,000 units.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES AND EQUATIONS

Chapter 1

INTRODUCTION

Indonesia is one of the largest palm oil producing countries, supplying almost half of the world's palm oil. Palm oil is widely used as vegetable oil for cooking, in food products, an ingredient for candles, body care products, soap, detergents, grease and lubricants for machinery in the industrial sector and as biofuels. Manufacturers and producers choose palm oil over other types of oil because palm oil gives a higher yield per ton of fruits.

Figure 1. Palm oil tree.

Figure 2. Palm oil fruits.

An individual palm oil fruit consists of the outer skin (the exocarp), a pulp (the mesocarp), a central nut consisting of a shell (endocarp), and the kernel. The weight of an individual fruit ranges from six to twenty grams. The exocarp is the very outer skin of the individual fruit. The mesocarp is the orange yellowish part in the middle (see Figure 2), between the exocarp and endocarp. This part is the main ingredient for palm oil, which gives the

carotenoids in the oil. The endocarp is the black circle surrounding the kernel. It is the inside shell of palm oil fruits that protecting the kernel. The kernel is the white part in the middle of the fruit. This part is used in palm kernel oil. On the tree, the individual fruits are in a bunch together. The weight of a fruit bunch varies between ten to forty kilograms. Fruit bunches usually are sold from the farmers to the processing plants. Before processing, the workers separate all the individual fruits from the bunch (Poku 2002).

The Sutopo Lestari Jaya (SLJ) is a company that produces palm oil, and was founded in 2003 with 2,250 hectares of plantation area. The SLJ plantation is located two hours from Palembang, the capital city of South Sumatera. Most of the palms were planted in 2003 and now are ready to be harvested. The company is looking at the feasibility of building its own processing plant in the near future. The area where the SLJ and the other few plantations are located is in rural area with limited access to convenient transportation. The land transportation route from the plantation to the city or to a processing plant is still under construction. However, the SLJ plantation has access to a river, allowing an easier means of transportation. Due to troubles of transportation, it is beneficial for the SLJ company and neighboring plantations to build their own processing plant. Because of the limitation in transportation, other plantations in the area will be able to sell their harvest to the SLJ processing plant, generating more revenue for the company.

The management team of the SLJ Company is considering building a processing plant with a capacity of thirty tons per hour. They predict that in the near future the surrounding area will be developed into palm oil plantations. According to accounts from other palm oil processing plant owners, a processing plant generates higher profits than the plantation itself.

Thus, the management team of the SLJ Company aims to expand the company through building a processing plant.

Problem Statement

Is the processing plant with a capacity of thirty tons of palm oil fruits per hour the optimal size for SLJ Company?

Hypothesis

If the processing plant with a capacity of thirty tons per hour is built by the SLJ Company, it will return a minimum average of twelve percent on investments over the next ten years.

Objectives

1) To calculate the accounting and economic benefits of building a processing plant.
2) To give broader views and more options toward the expansion of the company.
3) To assess the processing efficiency in the palm oil processing plant.

Justification

The palm oil industry can be classified into different categories. The first category is the ownership. A palm oil plantation can be owned by the government, which aims to open more job opportunities for the locals. It also can be owned by non-government organizations (NGO). Around eighty-eight percent of palm oil plantations in Indonesia are owned by NGO (Savitry 2006). The second category is the size of the plantation. A small-scale plantation is cultivated by a family with an area less than ten hectares. These farmers usually sell the fruits to a processor. The size of a medium-scale plantation ranges from ten to five hundreds hectares. Some owners of a medium scale plantation might have their own processing plants while some only sell their fruits to a processing plant. The owners who have a processing plant usually buy fruits from other plantations in the surrounding area. The size of a large-scale plantation is more than five hundred hectares. Most of these large-scale plantations also have their own processing plant (Poku 2002). According to Euromonitor, there are at least twenty big companies, which are categorized in the large-scale plantation plants in Indonesia. Indonesia contributes 44 percent of the world palm oil production, which is around 15,900,000 Tons in 2006. 70 to 80 percent of palm oil production in Indonesia comes from Sumatera Island. South Sumatera province, where the SLJ company is located, is one of the major palm oil producers (USDA-FAS 2007).

Chapter 2

REVIEW OF LITERATURE

Palm Oil Industry

With the significant increase in the consumption of palm oil during the past few decades, the palm oil industry has responded to the demand by expanding extensively. This growth was driven by ever-increasing global demand for edible oils. The past few decades have seen rapid expansion in the production of two major edible oils, soybean oil in South America and palm oil throughout the tropics and stretching into the sub-tropics. This rapid expansion has been able to provide the world with its increasing demand for vegetable oil and because of the palm's productivity at a price, which is affordable to rising needs in third world countries. It presented itself as a cheap and reliable product for countries. Even with many different substitutes of oilseeds and other commodities, the production has expanded tenfold since 1961 (FAOSTAT 2009). The expansion of the industry is supported by the high productivity of palm oil, yielding more oils per hectare than other oilseed commodity. Through the analysis of rattan, rubber, and palm oil in East Kalimantan, Indonesia, Belcher, Rujehan, and Achdiawan (2004) computed the net present value and other financial analysis of each commodity. The study was conducted to look at the changing use and management of forest product in East Kalimantan because the traditional land-use was under pressure by a range of factors, including government policy. The

result shows that palm oil gives the best of the land use options, when considering the profitability per unit of land compared to rattan and rubber.

Another reason why the producers choose palm oil over other oilseeds is because palm oil is cheaper compared to other oilseeds; especially soybean. Palm oil also can be used as a major component of consistent or solid fats without hydrogenation, which requires only a little reprocessing before use and possesses specific property of value (Berger 1986). In addition, palm oil is semi-solid at room temperature, making it ideal for baking and food production. Many food manufacturers are trying to find alternatives to trans-fat, partially hydrogenated oils, which contribute to heart disease and other medical problems. Although palm oil is not directly contributed to heart disease, the focus on the trans-fat issue has resulted in palm oil being considered more healthful than some other fats. Berger lists and compares products that use oil (palm or soybean) as one of their ingredients. He explains a number of specific food applications and formulas related to the use of palm oil. A palm mid-fraction is highly compatible with cocoa butter. The producers have a wide range of options when processing palm oil fruits. As Berger mentions, the producers are not competing in the same level of playing field because of this wide range of options. For example, soap is the largest user of the fat in palm oil because palm stearin is competitive with tallow in price. It also offers cost savings because it requires less clean up for soap manufacturers. Not only the fruits can be used as oil, but also the byproduct from the oil processing can be converted into other products. The possibility of using the byproducts will maximize the use of palm oil fruits.

Efficiency in Palm Oil Processing Plant

Efficiency in a processing plant is essential in a business plan, as it is of high importance. By building an efficient processing plant, it will help companies maximize profits and minimize costs. Developing a processing plant model will help the company to analyze data better. It allows the company to check through all the steps and make them more efficient (Von Oppen and Scott 1976). Von Oppen and Scott were concerned about implementing a new and efficient agriculture industry in order to maximize the social welfare. The authors developed a model of the soybean processing sector to help them analyzed the data. Then, the authors found out that the application of the spatial equilibrium model for plant location and interregional trade may help decision makers to recognize the principles involved in the spatial allocation of agriculture-based processing industry. One way to become more efficient is to choose equipment or a system that supports the operation that is more efficient as Moe (2001) discusses with the various systems in an onion processing plant. With graphs and simple mathematics, Moe illustrates that an aerobic digester combined with a micro-turbine is more cost-beneficial in the long run than the California power grid in the onion processing plant. The decision was made based on the payback period of the onion processing plant.

Kalam and Masjuki (2002) did some research on advanced technology in biofuels processing can be as efficient as possible. They discussed the effect of anticorrosion additive in biodiesel (from palm oil) on diesel engines, performance, emissions and wear characteristics, which relate to the machine efficiency. The authors believe that a significant level in terms of physiochemical properties of biodiesel has been obtained but a lack of full or partial replacement of fossil fuel needs to be discussed further. Besides choosing efficient equipment or the system,

different types of managements also have a part in optimizing the daily operations. The increased demand of oil palm in Southeast Asia has drawn many attentions toward a large-scale plantation development. In the article, Cramb and Ferraro (2010) analyzed a financial model of an oil palm plantation in Sarawak, Malaysia. They found that there was a trade-off between the efficiency and equity outcomes of the alternative arrangements. However, when they took the actual performance of the alternative schemes into account, improved managements was the key to achieve developmental potential (Cramb and Ferraro 2010).

To be able to build an efficient palm oil processing plant, the management of a company should carefully choose the right size of the plant. This can be approached by analyzing various levels of utilization using investment return, payback period, and break-even analysis methods. For example, a study was conducted in The Salyer Land Company to determine whether the company grows enough oilseeds to operate an efficient size of processing plant. A processing plant of 500 tons/day was analyzed at various levels of utilization with its estimation of construction and operating costs (Salyer 1979). The author made the decision by using the three methods: investment return, payback period, and break-even analysis. Rosa (2009) also agrees that the optimization of a processing plant can be improved by examining the consequences of scale and logistic problems related to the size of the processing plant. In the article, Rosa discusses the biodiesel processing plant's economies of scale by analyzing the optimization process of the agro-biodiesel chain in different simulation of participative models of cooperative/non-cooperative chain agreements. It examines the consequences of scale and logistic problems related to the size of the processing plant. In addition, it also examines the size and characteristics of the supply area related to the dispersion of the farm in the supply area. The results shows the relationship between the choice of specific organization form and results

obtained, the importance of the scale economies and logistic costs implied in the enlargement of the supply area, and the type of farms that are in the supply area. Market price trends of biofuels commodity are found to be the most important aspect, which could discourage operators from long-term investments if the rate of return is low.

Efficiency in production also involves the management in reducing the byproduct as well as converting the byproduct into a useful product. Abel (2006) shows the feasibility of having a business that converts the byproducts, citing that it can be as profitable as other businesses. The study was conducted in Santa Barbara and San Luis Obispo County to determine whether it would be feasible to collect waste cooking grease from a restaurant and transport it to a processing plant. The result of the study showed that there was a lot of supply from the restaurants within this area to sustain the capacity of a full time service truck. The author used business start up costs, operating costs, and projected revenue to generate the financing of the business. Based on the research, the author believes that this estimation of profit is adequate for a one-person operation.

Sustainable Palm Oil Processing Plant

Another major factor of palm production is its role in sustainable energy campaigns in either the productions countries or the consumptions countries around the world. European countries are in support to promote the use of palm oil by subsidizing hundreds of millions of dollars into national subsidies towards bio-diesel. Europe is now the leading importer nations of palm oil consumptions. Through the subsidizing of biofuels, European governments have accelerated the demand for palm oil in Europe. As the result, it has accelerated the conversion of

large areas of rainforest in productions countries, mainly in South East Asia region. Palm oil plantations are often expanded by clearing existing forest land and draining swamps (USDA – FAS 2007). This leads to an issue that people around the world are concerned about, which is the environmental impacts of palm oil production and plantation. The rapid expansion has naturally put pressure on the environment and on societies where the palm tree is grown. While better management of plantations and oil palm smallholdings serve as models of sustainable agriculture, in terms of economic performance as well as social and environmental responsibility, there is a concern that not all palm oil is always being produced sustainably. Development of new plantations has resulted in the conversion of large areas of forests with high conservation value and has threatened the rich biodiversity in these ecosystems. The use of fire for preparation of land for oil palm planting on a large scale has been reported to contribute to the problem of forest fires in the late 1990s. The expansion of oil palm plantations has also given rise to social conflicts between indigenous communities and growers in some places. Therefore, sustainable palm oil is seen as a way forward to continue to supply the world with its much-needed vegetable oil without harming the planet and its people.

Kathuria and Khan (2002) describe the growth of the palm oil industry, which has negative impacts on the environment in Malaysia. It not only affects the environment, but also increases the cost of living near the processing plant. It also increases the company expenses because clean water is not easily accessible and results in an increase in cost. The government came up with regulations to control the pollution that was caused by palm oil plants. After the regulation was enacted, it resulted in pollution reduction over several years. However, sustainable palm oil production can be one of the options in order to reduce negative responses from consumers around the world. Research has found that sustainable palm oil production has

higher benefits from the higher yield of the different processes of breeding and mineral fertilizations. In addition, the company will save some time and money from problems that might arise because of environmental protection regulations imposed by the government (Tailliez, et al. 2005). According to USDA Foreign Agriculture Service, the Indonesian government recently has been working with some palm oil producing companies to negotiate sustainability standards with Europe and the United States under the organization named Roundtable on Sustainable Palm Oil (RSPO). RSPO is an international organization which brings together producers, distributors, conservationists and other stakeholders in palm oil industry. The positive feedback of the sustainable practices was able to make back into the work force and the surrounding community. With all the sustainability efforts which were made by the producers, palm oil will attract more consumers in the future. The efforts will continue to expand by the continuing research and development work in both top producing countries, Indonesia and Malaysia (USDA-FAS 2007).

Chapter 3

METHODOLOGY

The purpose of this section is to estimate and calculate the cost of the processing plant, the cost of manufacturing and running the processing plant, and the average return on investment. The format of study will be an economic feasibility study.

Procedures for Data Collection

Table 1. Data Descriptions

Cost Analysis	**Profitability Analysis**	**Feasibility Study**
1. Cost of the building a. Brick b. Sand c. Cement d. Rebar e. Doors and windows 2. Cost of equipment a. Processing machines b. Packaging machines c. Other machines 3. Other factory cost 1. Furniture 2. Buckets to wash palm oil fruits 3. Container to store palm oil fruits	1. Sales revenue a. Estimated total production b. Selling Price 2. COGS – FFB price 3. Operational expenses a. Processing b. Maintenance c. Overhead 4. Interest expenses 5. Tax	1. Net Present Value a. Cost of investment b. Expected profit (net income) c. Rate of interest or rate of return d. Payback period 2. Break-even analysis a. Total fixed cost b. Price c. Average variable cost

The data will be divided into three main sections: the cost analysis, profitability analysis, and the feasibility study. Using these three types of data, the author will analyze the economic feasibility of the processing plant over the next ten years.

The cost analysis data or the development cost is divided into three categories. The first category is the cost of the building, which will be obtained by consulting with a construction company. The second category is the cost of the equipment, which will be obtained through interviews and by visiting other processing plants. The interview will be conducted by the author and the management team from the company. It is necessary to visit other processing plants so that the author will get broader views of different types of machinery that other processing plants use. It will also help the SLJ Company to choose machines that are more efficient will increase its economies of scale. The third category is other factory cost which does not fit into the first two categories. This cost will include the cost of “inexpensive” items, which are not directly related to the processing of palm oil.

The second section of the data is profitability analysis data or operation cost and income. The possible profit returns will be analyzed by the author using the current market data of the price of palm oil fruits (fresh fruit bunch), the price of crude oil palm (CPO) and its related products (for sale price). Other costs in this section will be estimated by the author with consultation from the SLJ management team and the author’s advisor. The expenses will be categorized as operational expenses. These expenses include processing, maintenance and overhead cost.

By using development cost, operation cost and income, the author will construct an economic feasibility analysis. The purpose of an economic feasibility study is to show that this investment will be profitable over the next ten years. The author will use the ‘Net Present Value’

method to calculate whether the SLJ company should invest in building a processing plant. The author will need the cost of the investment, in this case the cost of the processing plant from the first data section, the expected profit for each year from the second data section, the rate of interest (assumption), and the payback period. Besides that, the author will also perform the break-even analysis to know when the SLJ Company will be break-even. The data for break-even analysis will be obtained from the previous calculations; total fixed cost, price, and average variable cost.

Procedures for Data Analysis

The author will perform a cost analysis using the first section of the data. In this analysis, the author will list all the possible cost of building a processing plant in different categories. After listing all the possible cost, the author will add all the cost in all the categories to get the total estimated investment.

Equation 1

Total Investment = Cost of the building + Cost of the equipment + Other factory cost

The second section of the data will be used in calculating the net income of the processing plant every month. First, the author will estimate the price of fresh fruit bunch (the main raw material used in the processing plant). For every ton of Crude Palm Oil, it requires five tons of fresh fruit bunch. The price of fresh fruit bunch (FFB) in South Sumatera will be determined by the government using the index “K” of 84.4% and yield of 15.62% in the calculations. The price of FFB depends on Crude Palm Oil (CPO) price or other final product of

palm oil. Second, the author will estimate the revenues, expenses, depreciation, interest expense and tax expense every month. The revenue will be estimated using the price of CPO multiplied by expected working hours in a month and multiplied by thirty tons per hour. The expenses will be estimated using another company data of operational expenses. The depreciation will be determined using a straight-line depreciation over 25 years which relates to common life expectancies in the industry. The interest expense will be computed at the rate 12% a year. The tax rate will be computed at the rate 25%. Finally, the author will create an estimate income statement using the collected data.

Equation 2

Revenue (Net Sales of CPO) = CPO ($/ton) x working hours (hour) x 30 tons/hour

Equation 3

COGS (FFB price) = CPO ($/ton) x index "K" x yield x 5

Equation 4

Operating expenses = [(Processing + Maintenance + Overhead without Depreciation) x working hours x 30 tons/hour] + Depreciation

Equation 5

Net income = (Revenue – COGS) – Operating expenses – Depreciation – Interest expense – Tax

The last part of the data analysis is to analyze the economic feasibility. The data for this analysis is obtained from the cost and profitability analysis. The author will construct a table for Net Present Value over the next ten years. Total net outflow is the total investment obtained from the first calculation. The author will compute the after cash tax inflow which is the sum of net income and depreciation. If the Net Present Value has at least ten percent return on investment,

then the SLJ Company can continue to build this processing plant. The author would like to add the break-even of this investment into consideration. The break-even analysis is obtained by dividing the fixed cost of this investment with the price and average variable cost.

Equation 6

$$\text{Net inflow} = \frac{After\ cash\ tax\ inflow}{(1+Kc)^t}$$

Equation 7

Net Present Value = Total net inflows – Total net outflows

Equation 8

$$\text{Break-even} = \frac{Total\ fixed\ cost}{Selling\ Price - Variable\ Cost}$$

Assumptions

The study assumes that the demand of palm oil keeps increasing and the SLJ Company will be able to sell all the products that have been processed and manufactured. A future price of palm oil price will be used, assuming that the average price in the next ten years will be close enough to the estimate price. The operation costs are based on another company's performance, which are already in the industry for more than twenty years. Because the SLJ Company is new to the industry and has different scale of production, the author assumes that it will cost the SLJ Company three times more than the other company has. The interest rate and tax rate are held stable at the rate 12% and 25% respectively. The working hours are estimated as 12 hours a day and 20 days a month. The author estimates the depreciation using the straight-line depreciation over 25years period.

Limitation

The assumptions used in this analysis preclude the economic downturn and any natural disasters. This study will only be meaningful for similar studies in Indonesia and other tropical countries where palm oil trees can grow. There was a limited access in gathering the future price of palm oil. Thus, the author chose the best price based on that limited data, which might not be too precise. In addition, the author could not get any specific palm oil company data which has similar size with the Sutopo Lestari Jaya Company. The author made adjustment based on the data gathered with the worst scenario of possibility. Because the author could only gather one specific palm oil data, the author could not compare the data and produce better assumptions.

Chapter 4

DEVELOPMENT OF STUDY

The study is conducted to help the Sutopo Lestari Jaya Company to analyze the accounting and economic benefits of having a new palm oil processing plant. This study will give broader views toward the expansion of the company as well as assess the processing efficiency in the palm oil processing plant. The management team of the SLJ Company addresses a problem of the palm oil processing plant's optimal size. After analyzing the data from other companies with a similar size, a processing plant with a capacity of 30 tons of palm oil per hour currently might be the optimal size for the SLJ Company. If the study shows that this investment will return a minimum average of 12% over the next 10 years, the size of this processing plant is optimal for the SLJ Company. The hypothesis is tested through three data analyses. The first data analysis is the cost of investment. The second data analysis is the income statement. The third analysis is the feasibility study. The third analysis computes a net present value with a return on investment of 12%. After the author gets the data from the third analysis, the author can either accept or reject the hypothesis.

Cost of Investment

The cost of investment data are gathered by the author with consultations with the management team and a construction company in Malaysia. The cost is divided into five sections; preliminaries, earthworks, civil and structural works, mechanical works, electrical works, and proprietary of equipment. (See Table 2)

Table 2. Summary of Investment Cost

Item	Descriptions	Amount
A	Preliminaries	$ 75,260.80
B	Earthworks, Civil, and Structural Works	$ 3,754,475,84
C	Mechanical Works	$ 5,029,075.88
D	Electrical Works	$ 653,666.00
E	Proprietary Equipment	$ 1,444,228.80
	Total	**$ 10,956,707.32**

(See Appendix 1)

Preliminaries cost consist of all the costs before the construction company starts building the plant, such as safety, site survey and setting out, site supervision, mobilization and demobilization. Earthworks, civil and structural works costs consist of all the costs related to constructing the building, such as sterilizer building, main process building, drains, concrete road and oil tank foundation. The mechanical works costs consist of all the costs related to the processing of palm oil, such as fruit reception, sterilization station, threshing station, and kernel recovery station. The electrical equipment works costs consist of all the costs related to the electrical works in the processing plant area such as, motor control starter panel, generator main and sub-main cables, motor and level control wiring, and overhead power line. The proprietary equipment costs consist of all the costs of machinery and related equipment, such as boiler, turbine, generator set, and decanter. This summary of cost gives a good estimate of the total cost of investment based on the total area of works and the capacity of the processing plant.

Profitability Analysis

In this section, the author does an analysis to get an estimate of the income statement the company will receive every month. In order to construct an income statement, the author needs data on revenue, cost of goods sold, processing expense, maintenance expense, overhead expense, interest expense, and tax. The SLJ Company will get its revenue from Crude Palm Oil (CPO), Palm Kernel Oil and some other by-products. In this study, the author will only focus on the Crude Palm Oil (CPO) because it is the main product. The price of CPO is determined by taking a lower future price of CPO, which is $973.20 per ton. When the project was written, the average future price of CPO for the next several years was above $1,000. Thus, the author assumes the worst scenario when analyzing the data. The estimated working hours are 12 hours a day and 20 days a month. By using equation 2 in Chapter 3, the sales revenue every month is approximately $7,007,040. The cost of the raw materials is computed using the price of palm oil fruits, also known as fresh fruit bunch (FFB). For every ton of CPO produced, 5 tons of FFB are used. The cost of FFB is based on the current CPO price with a basis of 84.40% and a yield of 15.62%. This is a general computation which is determined by the Department of Agriculture in South Sumatera. By using equation 3 in Chapter 3, the cost of goods sold every month is $4,618,789. The difference between the revenue and the cost of goods sold is shown as gross profits.

The operating expenses are estimated using another private company in South Sumatera. Based on this company's data, the processing expense is $16.92 per ton of CPO. The maintenance expense is $4.83 per ton of CPO and the overhead expense, not including the

depreciation, is $2.29 per ton of CPO. However, because this company has a larger scale compared to the SLJ Company, the author multiplies the expenses by three, assuming that the SLJ Company is new in the industry and not as efficient as the other company. For the depreciation, the author takes the total cost of investment and depreciates it over 25years lifetime with straight-line depreciation. The total depreciation for each month is $36,522.36. By using equation 4 in Chapter 3, the total operating expenses every month is $555,594. The difference between gross profits and total operating expenses is known as operating income. Other expense, which will be included in the income statement, is interest expense. Interest rate in Indonesia on average is 12%. Interest expense is computed by constructing an amortization table over ten years with the loan amount of $10,956,707 (total investment). The amortization table shows the payment that needs to be made every month, interest expense occurred each month, change in principal and the remaining balance (See Appendix 3). In the first few years, the SLJ Company has to pay around $100,000 for the interest expense. As the payments are made through the years, the interest expense will decrease. For this study, the author calculates the total interest expense that the SLJ Company will have to pay and divides the total expense equally across every month over ten years period. The total interest expense that the SLJ Company will have to pay is $7,906,923 and the interest expense, which will be shown in the income statement, is $65,891 every month. In reality, the SLJ Company will have lower net income in the first few years. The net income before taxes every month will be $1,766,766. With 25% tax rate in Indonesia, total tax which needs to be paid is $441,692 per month. By using equation 5 in Chapter 3, the income statement every month has a net value of $1,325,075. (See Appendix 2)

Feasibility Study

After getting the two data, the cost of investment and the net income every month, the author computes the net inflow over the next ten years. The SLJ Company net income every year is $15,900,895. Cost of capital (Kc) is computed as 11% because the SLJ Company would want at least 12% rate of return on investment. By using equation 6 in Chapter 3, the total net inflow is $93,644,059. By using this total net inflow, the net present value can be computed (see equation 7 in Chapter 3). The net present value of this investment is $82,687,352 (See Appendix 4). The fixed costs for the break-even analysis are the repayment for the investment cost, depreciation expense and interest expense per month. The variable costs consist of the processing, maintenance, and overhead costs per ton. In this analysis, the author uses the selling price at $973.20 per ton. By using equation 7 in Chapter 3, the SLJ Company will breakeven at 1,000 tons per month, given the current fixed cost, variable cost and selling price. (See Appendix 5)

Empirical Results of the Tests

Based on the net present value analysis, the author accepts the hypothesis. By making this investment, the company will gain $82,687,352 over the next ten years. The SLJ Company only needs 1,000 tons per month to be break-even at the current fixed and variable cost. Meanwhile, the expected sales will be 7,200 tons per month. Thus, the investment of building a processing plant will be beneficial to the SLJ Company because it has potential accounting and economic benefits. It is an opportunity for the company to make the investment.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study is to explore the economic feasibility of establishing palm oil processing plant for the Sutopo Lestari Jaya Company in South Sumatera, Indonesia. A processing plant with a capacity of thirty tons per hour is analyzed in this study. The study is divided into three categories: cost, profitability and feasibility. The cost of investment is estimated by the construction company based on the data provided by the management team of the Sutopo Lestari Jaya Company. The profitability analysis is measuring the net income or loss of operating the palm oil processing plant per month. By using the development cost and income statement, the author constructs an economic profitability analysis. In this analysis, the author analyzes if the investment will return a minimum average of twelve percent over the next ten years by using the net present value method.

The net present value of this investment has a positive value of $82,687,352. This means the investment will bring a net gain of $82,687,352 for the SLJ Company after it operates. Thus, the hypothesis of the study is accepted because the investment returns a minimum average of twelve percent over the next ten years. In addition, the SLJ Company will breakeven at 1,000 tons per month while the expected sales are 7,200 tons per month.

Conclusion

A palm oil processing plant with a capacity of thirty tons per hour is a feasible size for the Sutopo Lestari Jaya Company at the current state. The investment will give a net gain for the SLJ Company and give a minimum return of 12%. The author uses 240 working hours as the estimate working hours in the analyses, which the author and the management team believe to be the optimal. The investment costs show that building the palm oil processing plant with a capacity of thirty tons per hour is a huge investment. The management team needs to consider it very carefully to avoid any loss in the future. The SLJ Company is new to the industry, so it does not have as much as capital like other companies, which have been in the industry for over ten years. However, based on this study, the author estimates that the SLJ Company will get a net income of $1,325,075 per month. The repayment for the investment cost will be paid off over the next ten years. The repayment each month will be $157,197. Thus, after repayment, the SLJ Company will gain about $1,000,000 every month. The investment has a net present value of $82,687,352, which means that if the SLJ Company invests today, it will get $82,687,352 gain from the investment in the present's value. Moreover, the SLJ Company only needs to produce 1,000 tons per month to cover all its fixed costs. With an estimate 240 working hours, the processing plant can produce 7,200 tons per month. Thus, the SLJ Company will benefit from the investment based on this analysis.

Recommendation

This is an initial study to help the management team of the SLJ Company to make decision if it is financially feasible to build a palm oil processing plant with a capacity of thirty tons per hour. The costs estimation is based on another company performance, which is already in the industry for more than twenty years. Even though the estimation gives a good overall picture, the management team has to make adjustments after the first two months of production, in order to get a more accurate projection of the long run. The working hour estimation is based on the author and the management team's assumption. Thus, it is necessary to make adjustments after the first few months of production and after the first year of production to make the annual budget plan. A further study might be needed to provide more inputs on the issues of efficiency and sustainability.

Reference Cited

Abel, Robert Paul. 2006. "Feasibility of a Business Collecting Waste Cooking Oil for Conversion into Biodiesel." Unpublished Senior Project, California Polytechnic State University San Luis Obispo, Project #06-0644.

Belcher, Brian, Ndan Imang Rujehan, and Ramadhani Achdiawan. 2004. "Rattan, Rubber, or Oil Palm: Cultural and Financial Considerations for Farmers in Kalimantan." *Economic Botany*. 58: 77-87.

Berger, K.G. 1986. "Palm Oil Products – Why and How to Use Them." *Fette, Seifen, Anstrichmittel*. 88:250-258.

Cramb, R. A., and Deanna Ferraro. 2010. "Custom and Capital: A Financial Appraisal of Alternative Arrangements for Large-Scale Oil Palm Development on Customary Land in Sarawak, Malaysia." Contributed Paper, 54th Annual Conference of the Australian Agricultural and Resource Economics Society, Adelaide.

Euromonitor International – Statistic. "Brand Shares (by Global Brand Name) - Retail Value RSP (US$ '000) Year-on-Year Exchange Rates." *Global Information Database*.

FAOSTAT. 2009. "Palm Oil Production Quantity." *Food and Agriculture Organization of the United Nations.* December.

Kalam, M.A. and H. H. Masjuki. 2002. "Biodiesel from Palm Oil – An Analysis of Its Properties and Potential." *Biomass and Bioenergy*. 23(December): 471-479.

Kathuria, Vinish, and Nisar A. Khan. 2002. "Environmental Compliance versus Growth: Lessons from Malaysia's Regulations on Palm Oil Mills." *Economic and Political Weekly*. 37(September):3993-3999.

Moe, Julie. 2001. "A Cost Benefit Analysis of Alternative Energy Sources for an Onion Processing Plant." Unpublished Senior Project, California Polytechnic State University San Luis Obispo, Project #01-1845.

Poku, Kwasi (2002). "Origin of oil palm." *In Small-Scale Palm Oil Processing in Africa*. FAO Agricultural Services Bulletin 148. Food and Agriculture Organization, United Nation.

Rosa, Franco. 2009. "The Profitability of Biodiesel Chain with Different Organizations" in *System Dynamics and Innovation in Food Networks 2009.* ed. M. Fritz, U. Rickert, G. Schiefer.

Salyer, Frederick Scott. 1979. "The Economic Feasibility Of Establishing An Oilseed Processing Plant In Corcoran, California." Unpublished Senior Project, California Polytechnic State University San Luis Obispo, Project #79-0960.

Savitry, Aninditta. 2006. “Palm Oil: Indonesia Takes Top Spot.” *Asia Food Journal Online*. (November).

Tailliez, B., JP Caliman, A Verwilghen, H Omont. 2005. “Scientific Research for Sustainable Palm Oil Production.” RSPO RT3. Singapore.

United States Department of Agriculture Foreign Agriculture Service. 2007. “Indonesia: Palm Oil Production Prospects Continue to Grow.” Office of Global Analysis.

Von Oppen, Matthias and John T. Scott. 1976. “A Spatial Equilibrium Model for Plant Location and Interregional Trade.” *American Journal of Agricultural Economics.* 58(August): 437-445.

APPENDIX

1. Cost of Investment Data

A. Preliminaries

No	Descriptions	Amount
1	Cost of Insurance	26,601
2	Safety	6,488
3	Site Survey And Setting Out	6,488
4	Mobilisation and Demobilisation	9,732
5	Temporary Site Office	6,488
6	Site Supervision	12,976
7	Temporary Workers' Quarters	6,488
	Total	75,261

B. Earthworks, Civil and Structural Works

No	Descriptions	Amount
1	Earthworks	324,400
2	Sterilizer building	366,021
3	Main process building	834,357
4	Clarification station, engine room, and boiler house	391,129
5	Loading ramp (foundation and concrete works)	472,197
6	Machinery foundation	432,944

7	Sterilizer condensate pit and sludge pit	94,400
8	Canteen	16,220
9	Office block & lab	71,368
10	Workshop & store	115,811
11	Toilet	4,866
12	Guardhouse, oil loading shed, carpark, raw water intake pump house, motorbike & bicycle shed B2&surau	44,767
13	Oil tank foundation	78,635
14	Fencing and main gate	43,470
15	Drains	188,152
16	Concrete road	259,520
17	Raw water treatment plant area	16,220
	Total	$3,754,476

C. Mechanical Works

No	Descriptions	Amount
1	Fruit Reception	469,958
2	Sterilization Station	580,514
3	Threshing Station	760,588
4	Pressing Station	460,161
5	Clarification Station	321,221
6	Depericarping Station	223,901
7	Kernel Recovery Station	593,749
8	Boiler House	236,715

9	Power House	50,931
10	Oil Storage Tank	278,368
11	Raw Water Treatment	243,495
12	Effluent Treatment	8,564
13	Fire Protection Equipment	27,347
14	Boiler Water Treatment	114,675
15	Piping System c/w Valves, Flanges, Joint Support & Fitting etc.	658,889
	Total	$5,029,076

D. Electrical Equipment

No	Descriptions	Amount
1	Synchronizing main switchboard & capacitor	58,392
2	Motor control starter panel	103,808
3	Distribution board	16,220
4	Generator main cables	61,636
5	Sub-main cables	145,980
6	Lightings & power points wiring c/w fittings	25,952
7	motor and level control wiring	136,248
8	Street lighting	22,708
9	Overhead power line	58,392
10	Earthing system	11,354
11	Lighting protection system	12,976
	Total	$653,666

E. Proprietary Equipment

No	Descriptions	Amount
1	Boiler (30TPH)	746,120
2	Turbine (1.2MW)	227,080
3	Genset (1 unit 400kW & 1 unit 250kW)	145,980
4	Decanter (3phase)	178,420
5	Desanding System (Double Cyclone module-Duplex Version)	16,220
6	Vacuum Drier c/w Pump	26,601
7	Purifier	55,148
8	Weighbridge	29,196
9	Surface Aerator	19,464
	Total	$1,444,229

2. Income Statement

PT. Sutopo Lestari Jaya Income Statement For the month ended			
Revenue			
Sales Revenue of CPO	7,007,040		
Cost of Goods Sold			
Cost of FFB	4,618,789		
Gross profit			2,388,251
Operational expenses			
Processing expenses	365,376		
Maintenance expenses	104,304		
Overhead expenses	85,914		
Total Operational expenses			555,594
Operating Income			1,832,657
Other expenses			
Interest expense			65,891
Net Income Before Tax			1,766,766
Tax			441,692
Net Income		**$**	**1,325,075**

Notes:			
a)	Selling Price per ton	$	973.20
b)	FFB per ton	$	128.30
c)	Processing costs per ton CPO	$	50.75
d)	Maintenance costs per ton CPO	$	14.49
e)	Overhead costs without depreciation per ton CPO	$	6.86
f)	Depreciation per month	$	36,522
g)	Total production per month		7200
h)	Interest rate		12%
i)	Tax rate		25%

3. Amortization Schedule

Beg. Balance	Month	Payment	Interest Expense	Change in Principal	Ending Balance
$10,956,707	1	$157,197	$109,567	$47,630	$10,909,077
$10,909,077	2	$157,197	$109,091	$48,106	$10,860,971
$10,860,971	3	$157,197	$108,610	$48,587	$10,812,384
$10,812,384	4	$157,197	$108,124	$49,073	$10,763,311
$10,763,311	5	$157,197	$107,633	$49,564	$10,713,747
$10,713,747	6	$157,197	$107,137	$50,059	$10,663,688
$10,663,688	7	$157,197	$106,637	$50,560	$10,613,128
$10,613,128	8	$157,197	$106,131	$51,066	$10,562,062
$10,562,062	9	$157,197	$105,621	$51,576	$10,510,486
$10,510,486	10	$157,197	$105,105	$52,092	$10,458,394
$10,458,394	11	$157,197	$104,584	$52,613	$10,405,781
$10,405,781	12	$157,197	$104,058	$53,139	$10,352,642
			.....		
$1,629,759	110	$157,197	$16,298	$140,899	$1,488,860
$1,488,860	111	$157,197	$14,889	$142,308	$1,346,552
$1,346,552	112	$157,197	$13,466	$143,731	$1,202,820
$1,202,820	113	$157,197	$12,028	$145,169	$1,057,651
$1,057,651	114	$157,197	$10,577	$146,620	$911,031
$911,031	115	$157,197	$9,110	$148,087	$762,944

$762,944	116	$157,197	$7,629	$149,567	$613,377
$613,377	117	$157,197	$6,134	$151,063	$462,314
$462,314	118	$157,197	$4,623	$152,574	$309,740
$309,740	119	$157,197	$3,097	$154,100	$155,641
$155,641	120	$157,197	$1,556	$155,641	$ 0

Notes:

a) Loan Amount	$ 10,956,707
b) Interest rate	12%
c) Payment per month	$ 157,197
d) Total interest expense in 10 years	$ 7,906,923
e) Interest expense per month	$ 65,891

4. Net Present Value

Year	Investment Cost	Net Income	Total	Present Value
0	(10,956,707)		(10,956,707)	(10,956,707)
1		15,900,895	15,900,895	14,325,131
2		15,900,895	15,900,895	12,905,523
3		15,900,895	15,900,895	11,626,597
4		15,900,895	15,900,895	10,474,412
5		15,900,895	15,900,895	9,436,407
6		15,900,895	15,900,895	8,501,268
7		15,900,895	15,900,895	7,658,800
8		15,900,895	15,900,895	6,899,820
9		15,900,895	15,900,895	6,216,054
10		15,900,895	15,900,895	5,600,048
Total Net Present Value				**$82,687,352**

Notes:

a) Cost of capital 11%
(For a minimum return of 12%, cost of capital must be at least 11%)

5. Break-Even Analysis

$$\text{Break-even} = \frac{Total\ fixed\ cost}{Selling\ Price - Variable\ Cost}$$

$$\text{Break-even} = \frac{\$259{,}610}{\$973 - \$\,714}$$

Break-even = 1,000 units

Notes:

a) Fixed cost: $ 259,610

b) Variable cost: $ 714

c) Selling Price: $ 973